

Solve for x

$$\textcircled{1} \quad 4e^{2x} - 3 = 2$$

+3      +3

$$\frac{4e^{2x}}{4} = \frac{5}{4}$$

$$\ln e^{2x} = \frac{5}{4}$$

$$\frac{2x}{2} = \frac{\ln(\frac{5}{4})}{2}$$

$$x = \frac{\ln(\frac{5}{4})}{2} \approx 0.112$$

$$\textcircled{3} \quad \ln_e(x) = 2$$

$$e^2 = x \approx 7.389$$

$$\textcircled{2} \quad 2(3^{2t-5}) - 4 = 11$$

+4      +4

$$\frac{2(3^{2t-5})}{2} = \frac{15}{2}$$

$$3^{2t-5} = 7.5$$

$$2t-5 = \frac{\log 7.5}{\log 3}$$

$$t = \frac{\frac{\log 7.5}{\log 3} + 5}{2} \approx 3.417$$

$$\textcircled{4} \quad \log_3(5x-1) = \log_3(x+7)$$

$$5x-1 = x+7 \quad \text{one-to-one}$$

-x      -x

$$4x-1 = 7$$

+1      +1

$$4x = 8$$

$$x = 2$$

## Example 1 Solving Simple Exponential and Logarithmic Equations

Original Equation	Rewritten Equation	Solution	Property
a. $2^x = 32$	$2^x = 2^5$	$x = 5$	One-to-One
→ b. $\ln x - \ln 3 = 0$	$\ln x = \ln 3$	$x = 3$	One-to-One
c. $\left(\frac{1}{3}\right)^x = 9$	$3^{-x} = 3^2$	$x = -2$	One-to-One
→ d. $e^x = 7$	<del><math>\ln e^x = \ln 7</math></del>	$x = \ln 7$	Inverse
e. $\ln x = -3$	<del><math>e^{\ln x} = e^{-3}</math></del>	$x = e^{-3}$	Inverse
f. $\log_{10} x = \underline{-1}$	$10^{\log_{10} x} = 10^{-1}$	$x = 10^{-1} = \frac{1}{10}$	Inverse

$$10^{-1} = x$$

$$\frac{3(2^x)}{3} = \frac{42}{3}$$

$$2^x = 14 \quad x = \frac{\log 14}{\log 2}$$

ex. 5

$$e^{2x} - 3e^x + 2 = 0$$

$$(e^x)^2 - 3e^x + 2 = 0 \longrightarrow (e^x - 2)(e^x - 1) = 0$$

$$\left\{ \begin{array}{l} x^2 - 3x + 2 = 0 \text{ where } x = e^x \\ (x - 2)(x - 1) = 0 \end{array} \right.$$

$$x = 2, 1$$

$$e^x = 2$$

$$e^x = 1$$

$$x = \ln 2$$

$$x = \ln 1 = 0$$

$$e^{2x} - 4e^x - 5 = 0$$

$$(e^x)^2 - 4e^x - 5 = 0$$

$$x^2 - 4x - 5 = 0$$

$$(x - 5)(x + 1) = 0$$

$$x = -1, 5$$

$$e^x = -1 \quad e^x = 5$$

~~$$x = \ln(-1)$$~~

~~$$\approx \emptyset$$~~

extraneous

$$x = \ln(5)$$

$$\approx 1.609$$

ex. 9

$$\ln(x-2) + \ln(2x-3) = 2 \ln x$$

$$\ln((x-2)(2x-3)) = 2 \ln x$$

$$\ln(2x^2 - 7x + 6) = 2 \ln x$$

$$\ln(2x^2 - 7x + 6) = \ln(x^2)$$

$$\begin{array}{c} 2x^2 - 7x + 6 \\ -x^2 \end{array} = \begin{array}{c} x^2 \\ -x^2 \end{array} \quad \text{one-to-one}$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$\boxed{x = \cancel{1}, 6}$$

$$7^x = 47$$

base      exp      Ans.

$$\log_7 47 = x$$

base      Ans      exp

$$x = \frac{\log 47}{\log 7}$$

exp.      answer      base

Sect. 3.4

#7-19(odd), 25, 37, 39, 45, 55-58